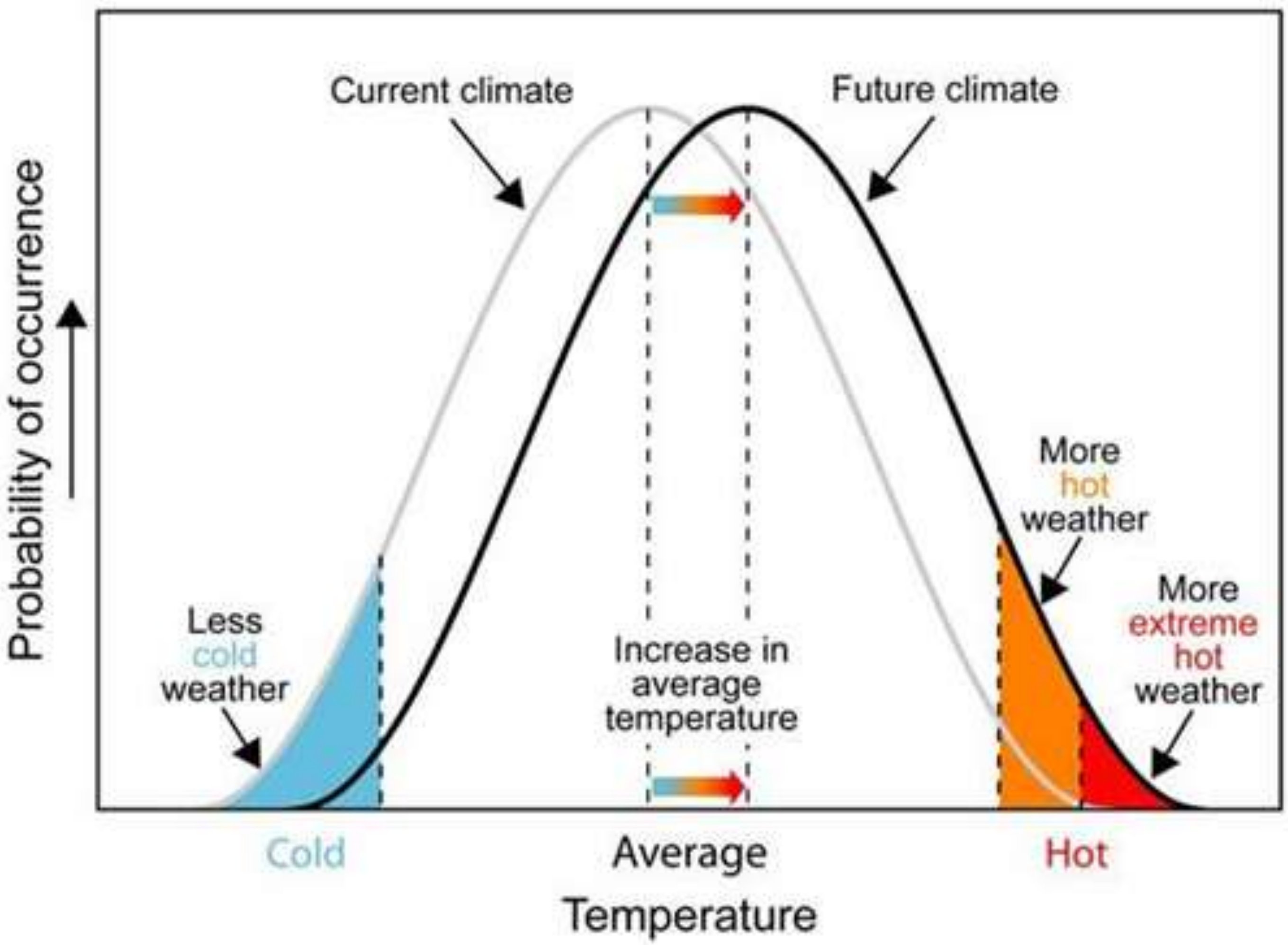
OUTREACH EVENT ON THE ACTIVITIES AND FINDINGS OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC),Tehran, I.R. of Iran
18 June2018

Climate extremes and their impacts

Mohammad Rahimi
Semnan University

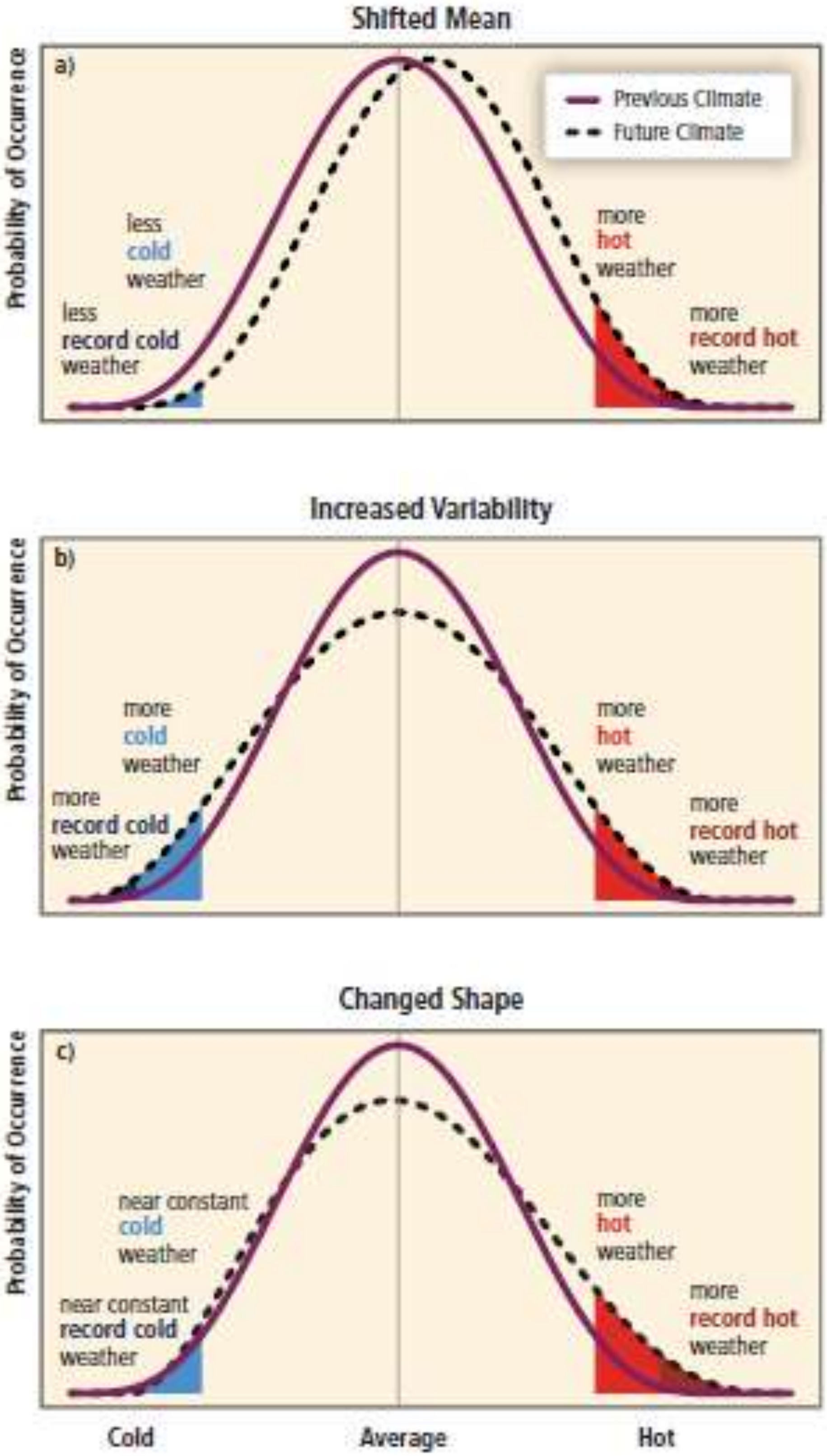
Climate Extreme is the occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range of observed values of a climate variable.



A changing climate leads to changes in extreme weather and climate events.

Scientists have been saying for years that climate change means we will see more extreme events and this is in line with those projections, even though it is not possible to attribute any one single event to climate change.

Extreme weather and climate events, interacting with exposed and vulnerable human and natural systems, can lead to disasters.



[Link 1]

[Link 2]

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO/ ETCCDI/ extreme temperature indices

- Frost days
- Summer days
- Ice days
- Tropical nights
- Growing season length
- Max Tmax
- Min Tmax
- Max Tmin
- Min Tmin
- Cool nights
- Cool days
- Warm nights
- Warm days
- Warm spell duration index
- Diurnal temperature range

WMO/ ETCCDI/ extreme Precipitation indices

Max 1-day precipitation
Max 5-day precipitation
Simple daily intensity index
No. of heavy precipitation days
No. of very heavy precipitation days
No. of days above 25 mm
Consecutive dry days
Consecutive wet days
Very wet days
Extremely wet days
Annual total wet-day precipitation

A changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of weather and climate extremes, and can result in unprecedented extremes.

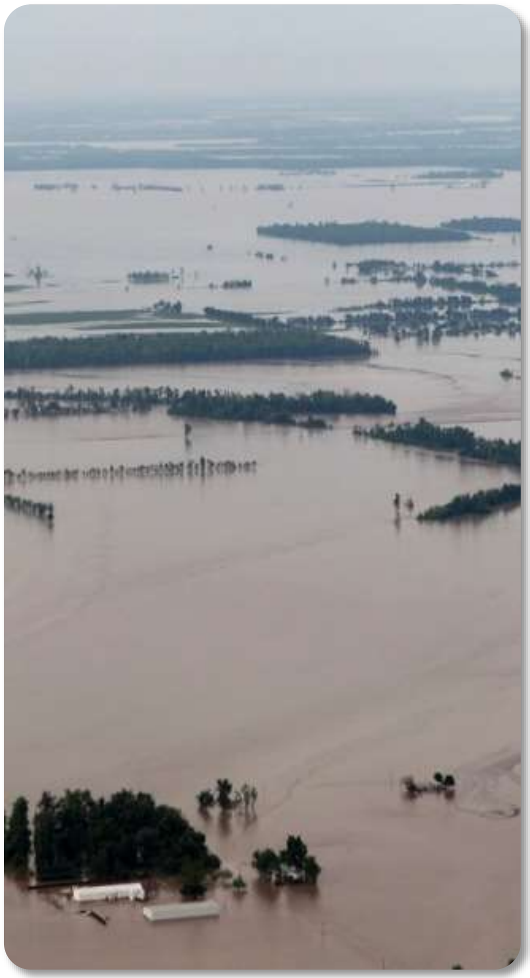
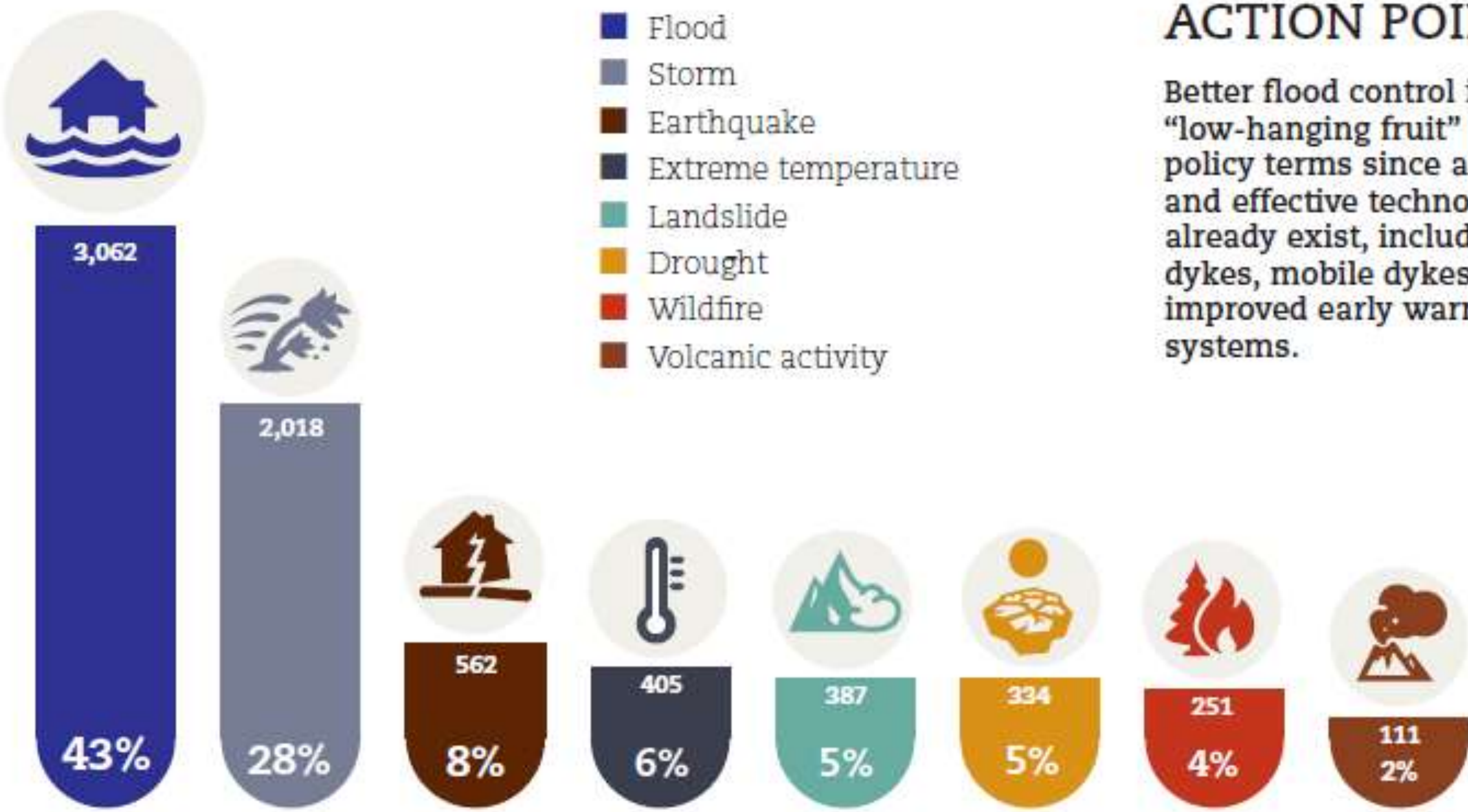



Figure 4

Percentage of occurrences of natural disasters by disaster type (1995-2015)



ACTION POINT

Better flood control is one "low-hanging fruit" in DRR policy terms since affordable and effective technologies already exist, including dams, dykes, mobile dykes and improved early warning systems.

IPCC Special Report on "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" (or…SREX)

- 2.5 years in preparation
- 87 Coordinating Lead Authors (CLAs) and Lead Authors (LAs)
- 18'784 review comments
- 4 Lead Author writing team meetings
- Approval plenary: Kampala, Uganda, November 2011
- Release of full report: March 28, 2012
- Joint IPCC WGI and WGII report

IPCC SREX: Contents - 9 chapters

1: Climate change: new dimensions in disaster risk, exposure, vulnerability, and resilience

2: Determinants of risks: exposure and vulnerability

3: Changes in climate extremes and their impacts on the natural physical environment

4: Changes in impacts of climate extremes: human systems and ecosystems

5: Managing the risks from climate extremes at the local level

6: National systems for managing the risk from climate extremes

7: Managing the risks: international level and integration across scales

8: Towards a resilient and sustainable future

9: Case studies

Impacts from weather and climate events depend on:

nature and severity of event

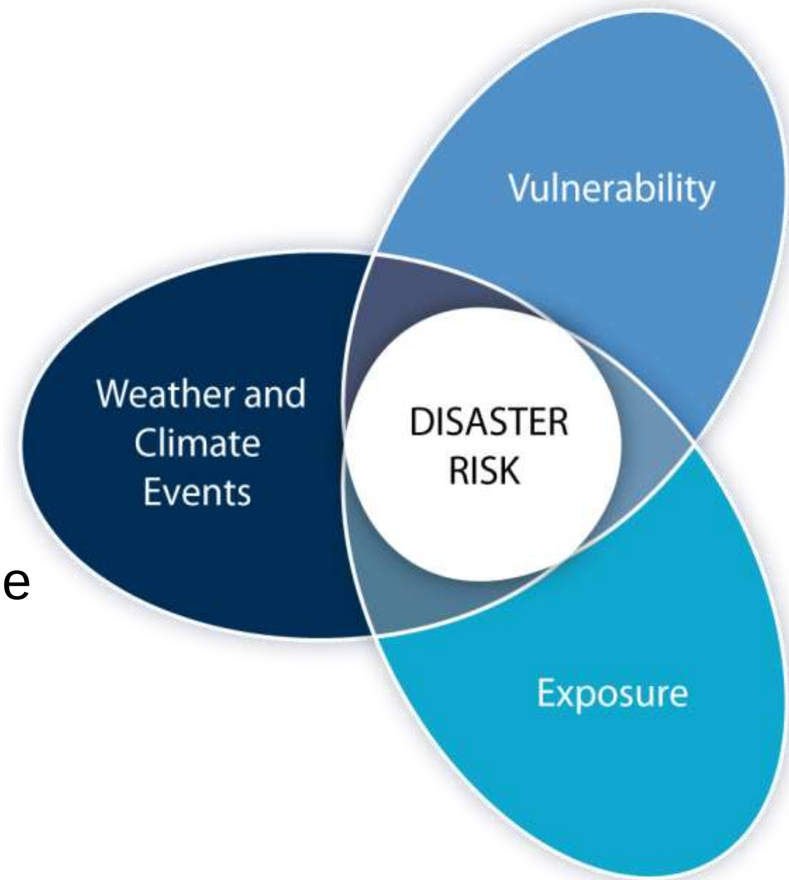
vulnerability

exposure

Increasing vulnerability, exposure, or severity and frequency of climate events increases disaster risk

Disaster Risk:

the likelihood of severe alterations in the normal functioning of a community or society due to weather or climate events interacting with vulnerable social conditions

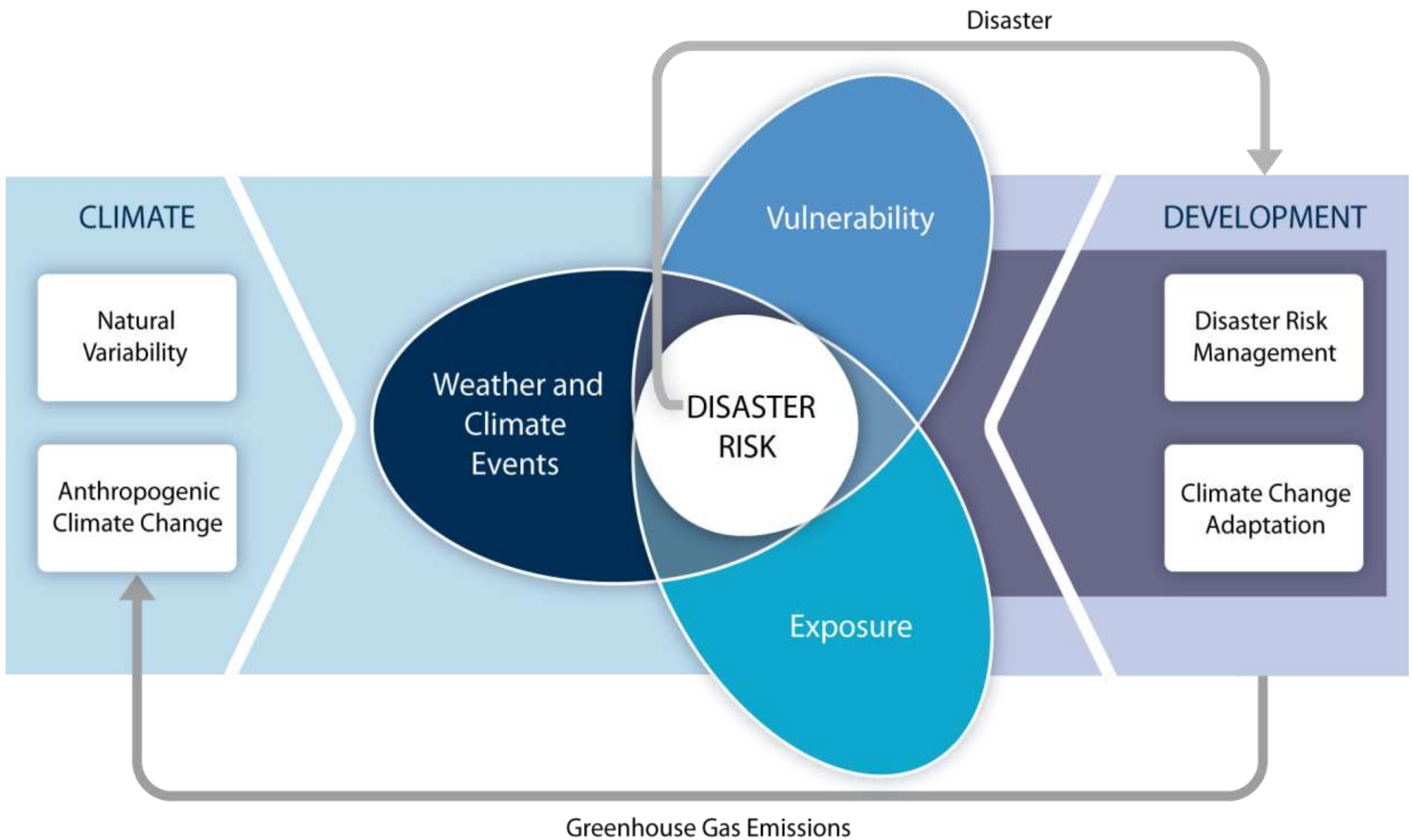


Vulnerability:

the predisposition of a person or group to be adversely affected

Disaster risk management and climate change adaptation can influence the degree to which ***extreme events translate into impacts*** *and* ***disasters***

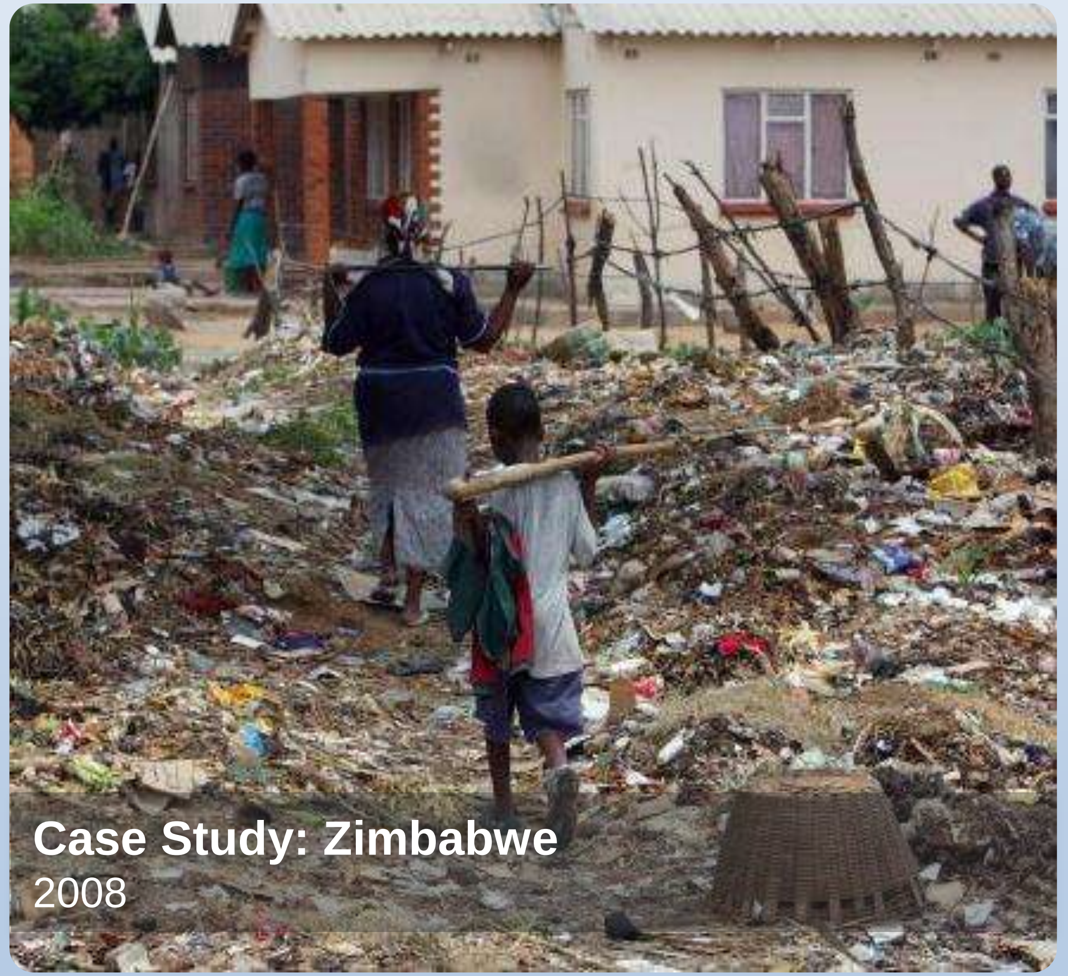
Increasing vulnerability, exposure, or severity and frequency of climate events increases disaster risk



Disaster risk management and climate change adaptation can influence the degree to which ***extreme events translate into impacts*** *and* ***disasters***

For exposed and vulnerable communities, even non-extreme weather and climate events can have extreme impacts

- Africa's largest recorded cholera outbreak
- over 90,000 affected
- over 4,000 killed
- began following onset of seasonal rains
- vulnerability and exposure increased risk



Impacts of climate extremes can be felt locally or regionally

AGRICULTURE	**“Mongolian herdsmen face starvation”** *March 14, 2000,* ***BBC World News***
ENERGY	**“Heatwave hits French power production”** *August 12, 2003,* ***The Guardian***
WATER	**“Drought returns to haunt Ethiopia”’** *May 19, 2008,* ***Reuters***
PUBLIC HEALTH	**“Cholera confirmed in Pakistan flood disaster”** *August 14, 2010,* ***Associated Press***
TOURISM	**“Alpine resorts feel heat during record warm spell”** *December 08, 2006,* ***CNN World News***
TRANSPORTATION	**“Flash flooding causes train to derail”** *July 30, 2001,* ***Chicago Sun Times***

Compound hazards

(occurrences of mean weather events one followed by another)/Not extremes

Compound hazards/Example 1

- January 2018
- dense fog was formed in the southwest part of Iran, high relative humidity
- dust phenomenon also happened simultaneously .
- formation of mud on the power transmission cables and junctions,
- Shutdown of power of many areas and cities

Compound hazards/Example 2

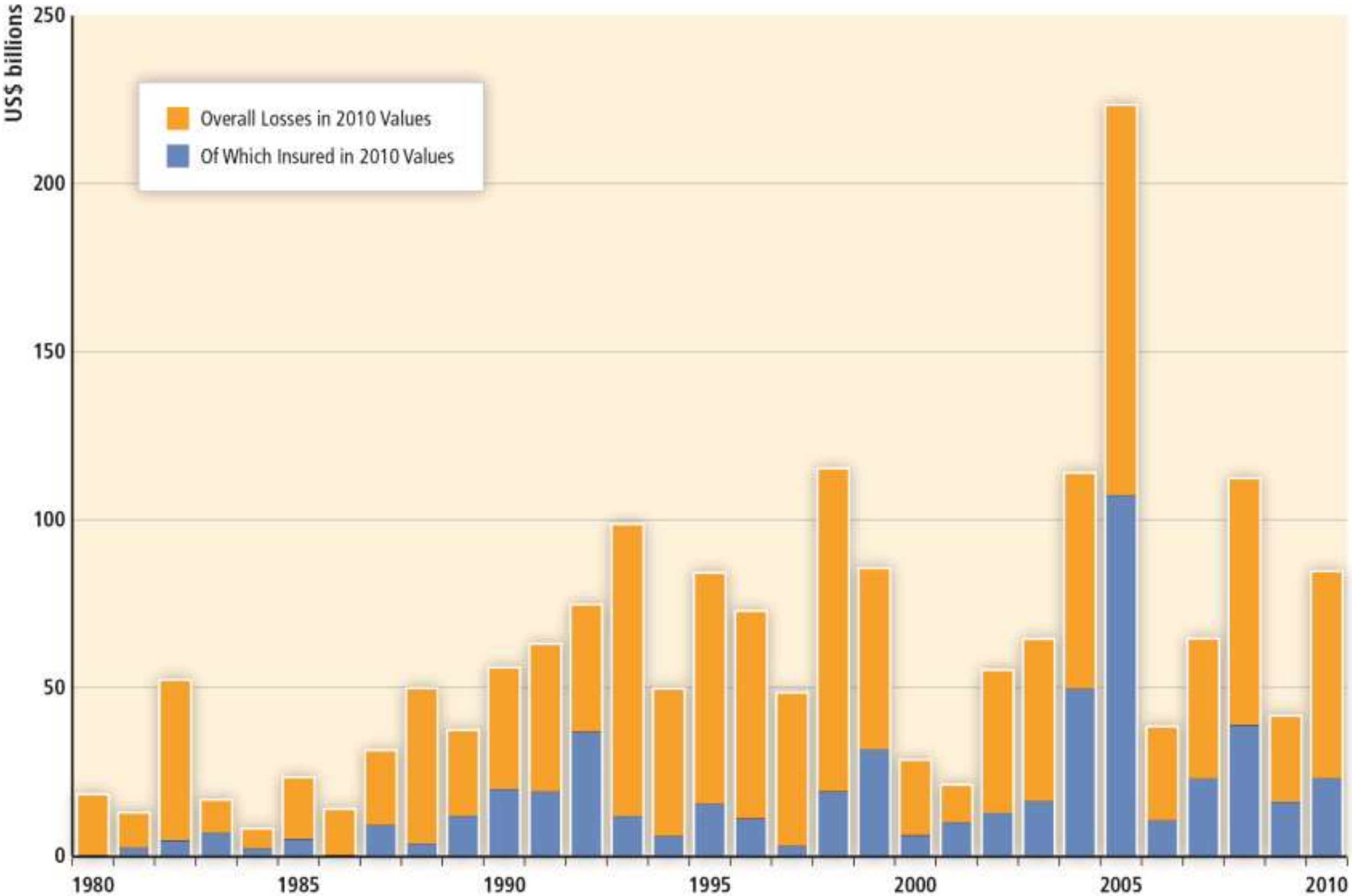
- summer of 2010,
- Russia was struck by an unprecedented heat wave
- a summer drought contributed to heat wave.
- The extremely dry and hot conditions led to widespread wildfires, which damaged crops and caused human mortality.
- The wildfires also induced large-scale air pollution in cities such as Moscow adding to the death toll caused by the heatwave. The incidents in Russia in the summer of 2010 can be termed a compound event, involving the co-occurrence of multiple dependent hazards: drought, heat, fire and air pollution.

Compound hazards/Example 3

- Mongolian Dzud 1999-2002 and 2009-2010.

- summer drought followed by extreme cold and snowfall in winter.
- *Dzud* is a compound hazard occurring in cold dry climate, and encompasses drought, heavy snowfall, extreme cold, and wind storms. It can last all year round and can cause mass livestock mortality and dramatic socioeconomic impacts – including unemployment, poverty, and mass migration from rural to urban areas, giving rise to heavy pressure on infrastructure and social and ecosystem services

Economic losses from climate-related disasters have increased, with large spatial and interannual variations



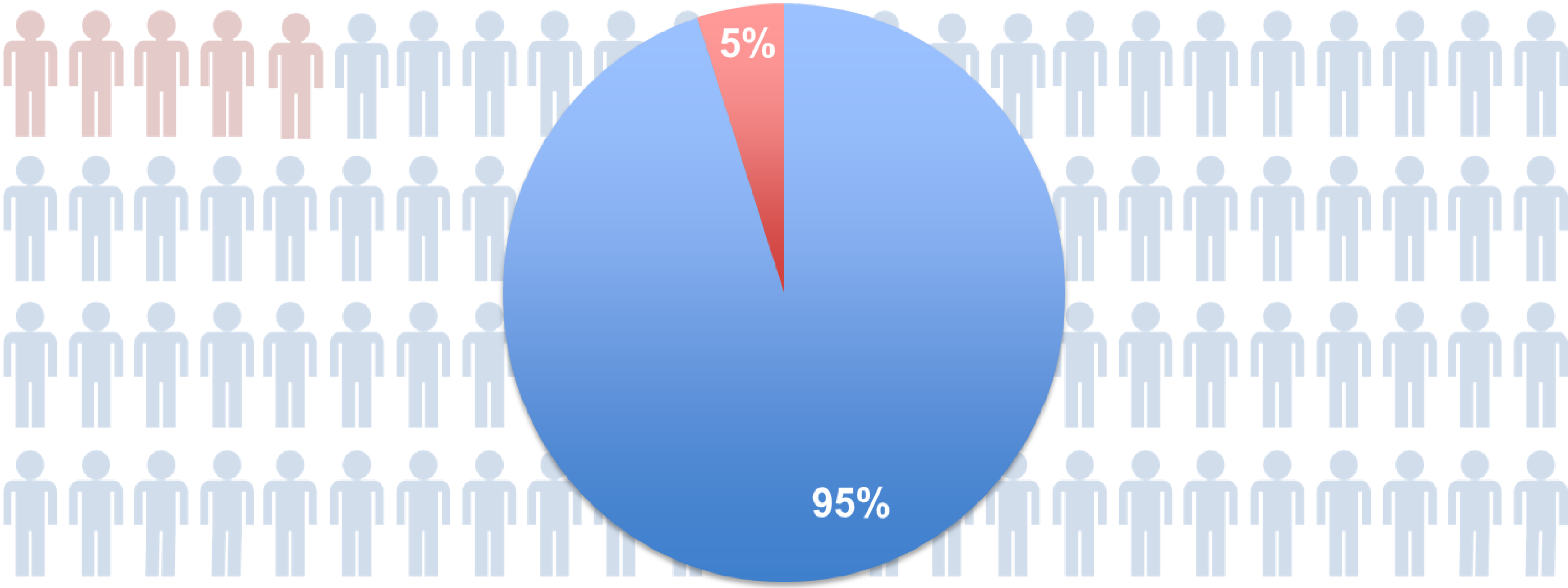
Data from Munich Re, 2011

Increasing exposure of people and assets has been the major cause of changes in disaster losses


Pakistan floods, 2010
6 million left homeless

Economic disaster losses are higher in developed countries

Fatalities are higher in developing countries

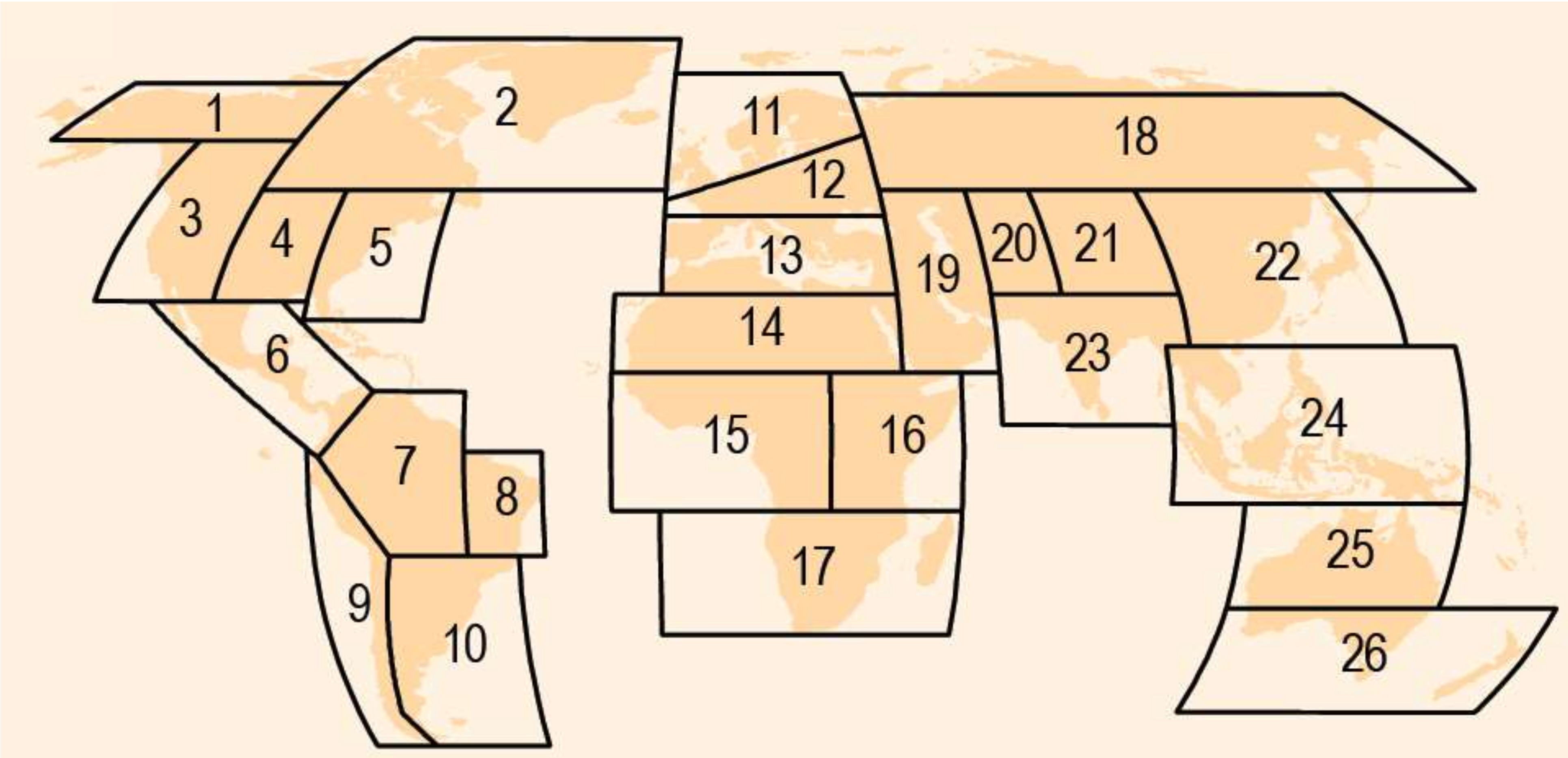


From 1970-2008, over **95%** of natural-disaster-related deaths occurred in developing countries

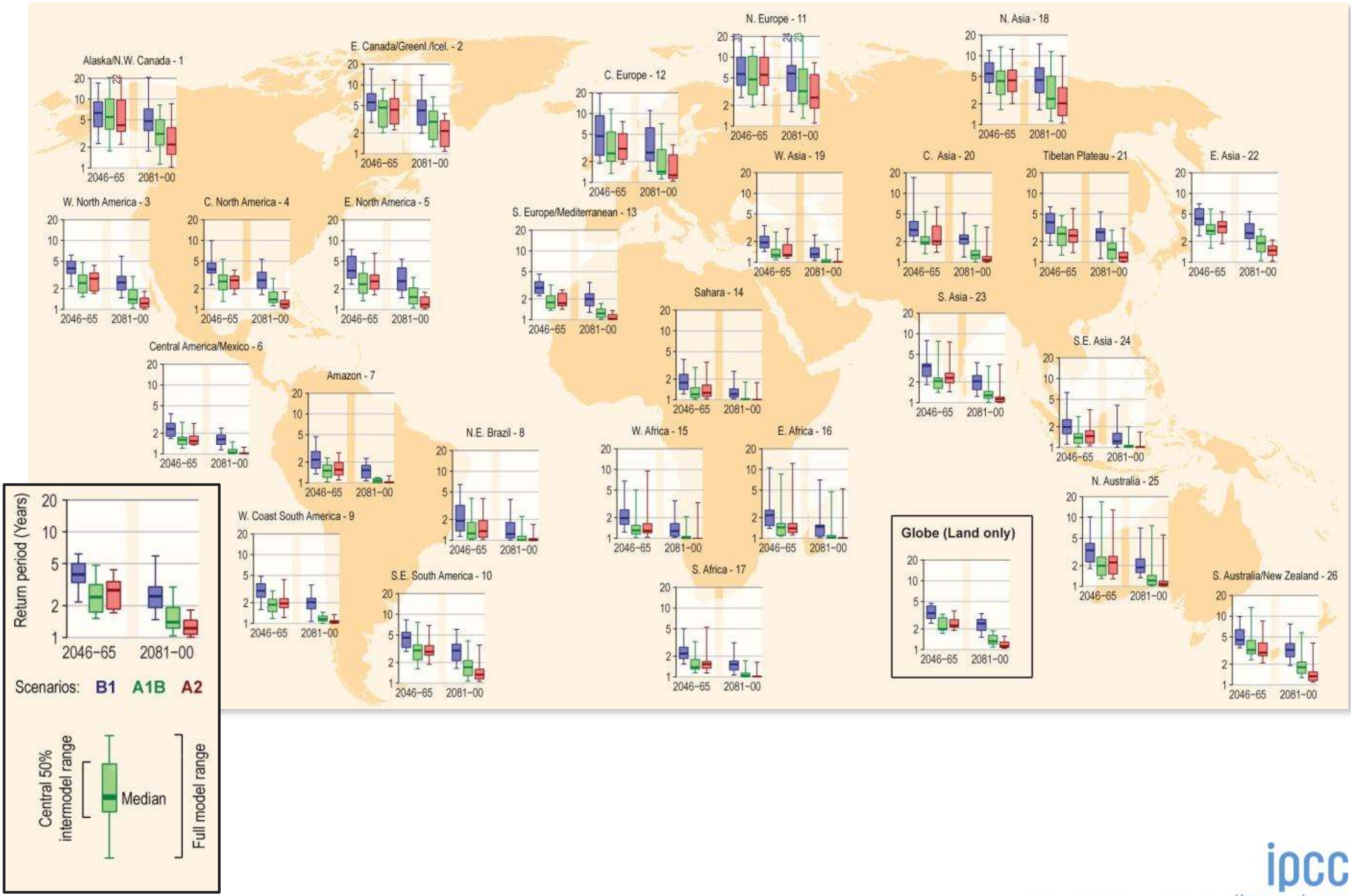
Since 1950, extreme hot days and heavy precipitation have become more common

There is evidence that anthropogenic influences, including increasing atmospheric greenhouse gas concentrations, have changed these extremes

Sub regions in SREX



Climate models project more frequent hot days throughout the 21st century



INTERGOVERNMENTAL PANEL ON climate change

Climate models project there will be more heavy rain events throughout the 21st century

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Key messages – observed changes

- ***Very likely*** **increase in warm days and nights** & **decrease in cold days and nights** on global scale
- ***Likely*** that **more regions have experienced increases** than decreases in **heavy precipitation events**
- ***Likely*** that there has been an **increase in extreme coastal high water** related to increases in mean sea level
- ***Low confidence*** in any observed long-term (i.e., 40 years or more) increases in **tropical cyclone activity**
- ***Medium confidence*** that some regions of the world have experienced more intense and longer **droughts**.

SREX Projections: Dryness assessments

Several types of measures can be used to quantify changes in dryness / drought:

• Reflect different dimensions of dryness (soil moisture drought, meteorological drought, hydrological drought)

SREX Projections: Dryness assessments

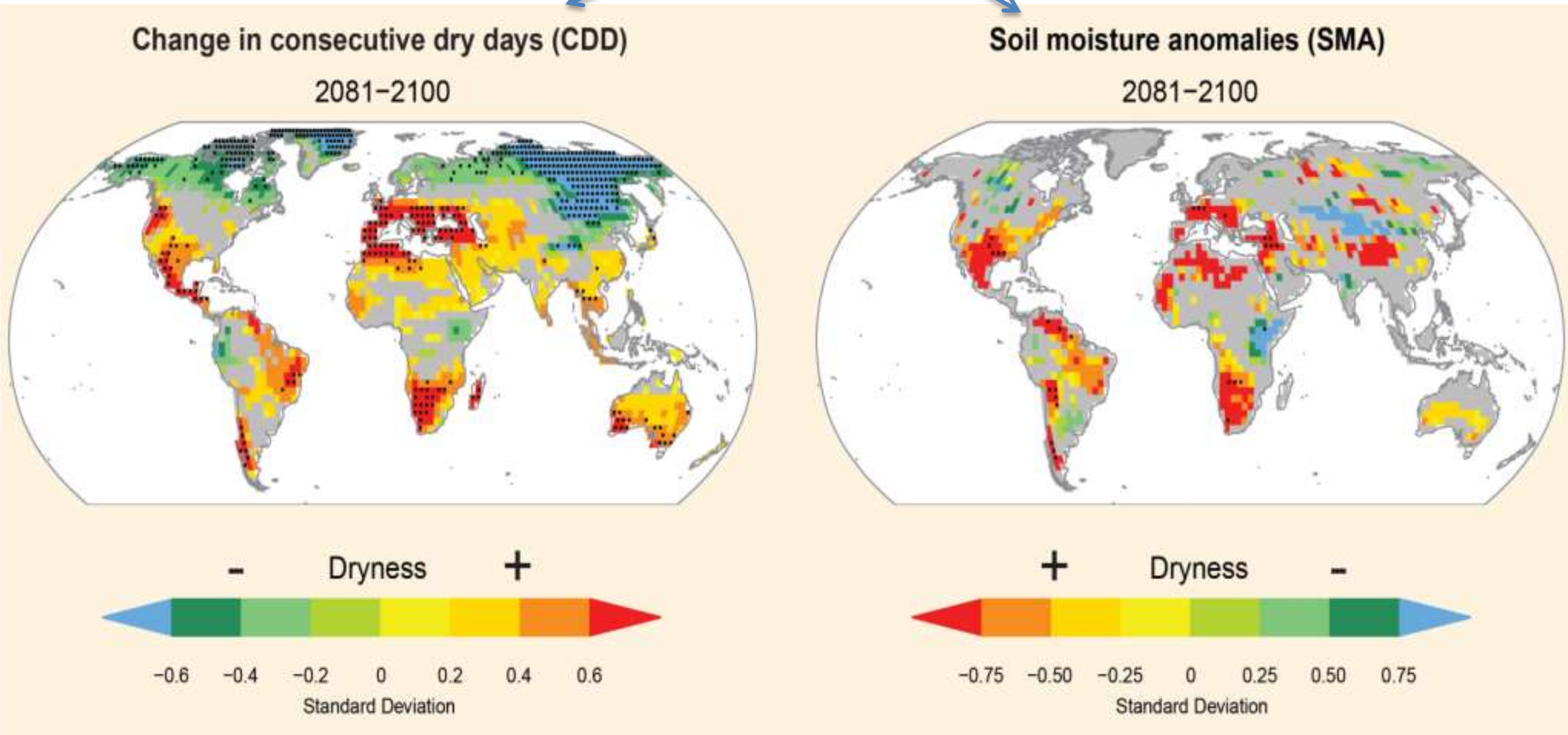
Several types of measures can be used to quantify changes in dryness / drought:

- Reflect different dimensions of dryness (soil moisture drought, meteorological drought, hydrological drought)

- Some examples:
  - **Consecutive Dry Days (AR4)**
  - **Soil moisture anomalies**
  - Standardized Precipitation Index
  - Palmer-drought severity index
  - …

SREX Projections: Dryness assessments

Two dryness indices



Gray shading: less than 66% model agreement on sign of change

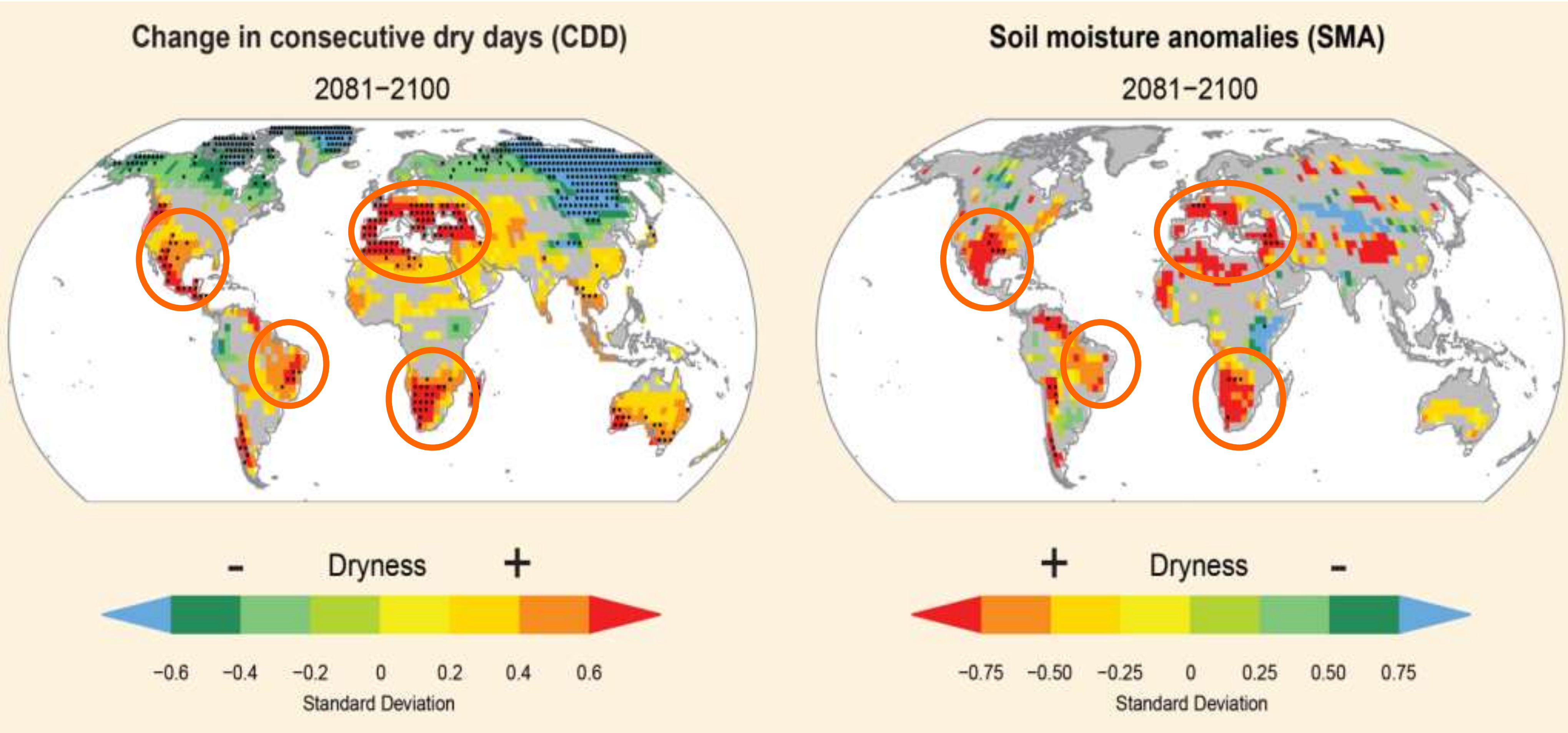
Coloured shading: ≥ 66% model agreement on sign of change

Stippling: ≥ 90% model agreement on sign of change

ipcc INTERGOVERNMENTAL PANEL ON climate change

SREX Projections: Dryness assessments

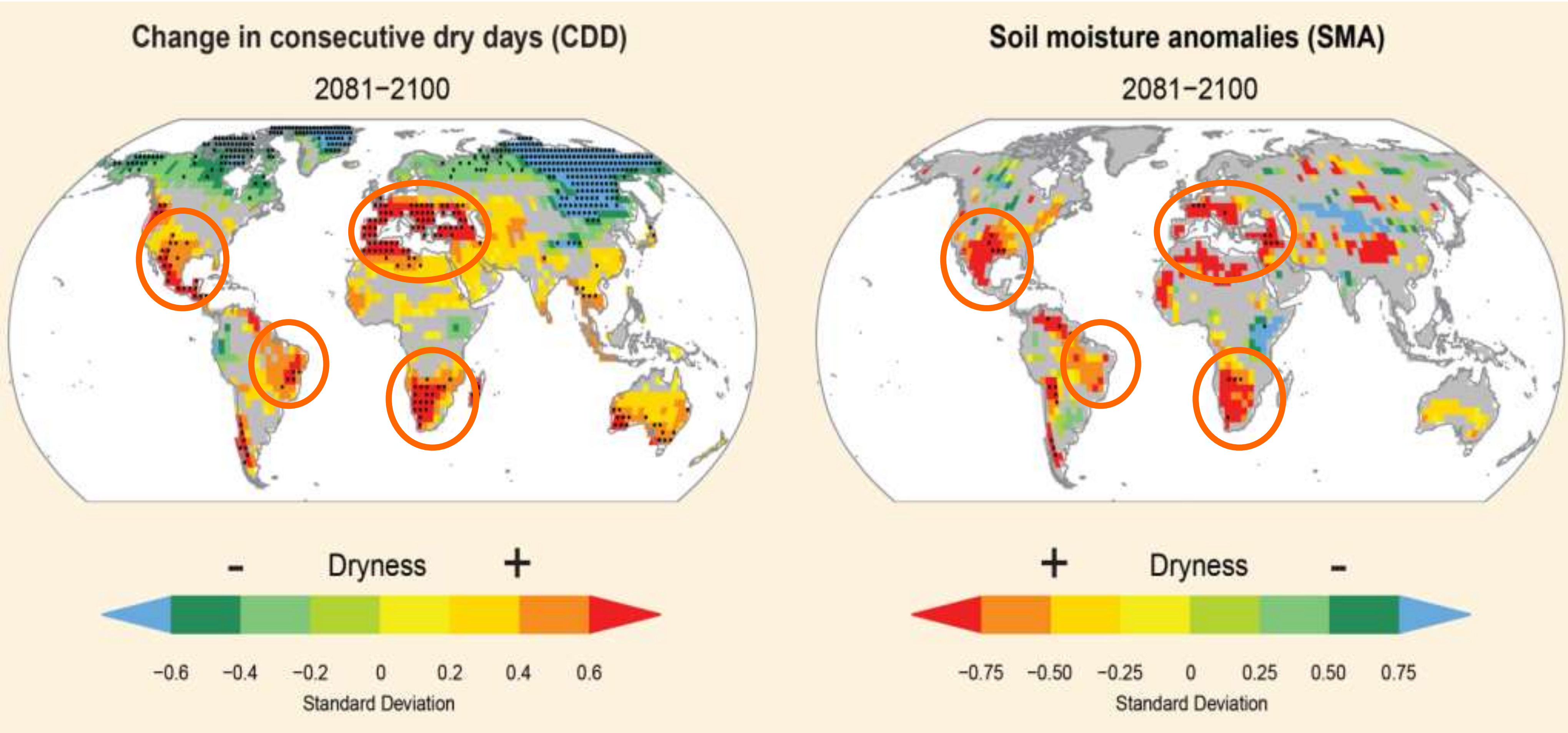
Consistency between indices



Consistent projections of increased dryness for these (and other) indices in the Mediterranean region, central Europe, central North America, Central America and Mexico, northeast Brazil, and southern Africa

SREX Projections: Dryness assessments

Consistency between indices



Consistent projections of increased dryness for these (and other) indices in the Mediterranean region, central Europe, central North America, Central America and Mexico, northeast Brazil, and southern Africa

Uncertainties in IPCC assessments

Term*	Likelihood of the outcome
Virtually certain	99–100% probability
very likely	90–100% probability
Likely	66–100% probability
About as likely as not	33–66% probability
Unlikely	0–33% probability
Very unlikely	0–10% probability
Exceptionally unlikely	0–1% probability

* Additional terms (*extremely likely*: 95–100% probability, *more likely than not*: >50–100% probability, and *extremely unlikely*: 0–5% probability) may also be used when appropriate.

Key messages – projected changes

- *Virtually certain* that increases in the frequency and magnitude of **warm daily temperature extremes** and decreases in **cold extremes** will occur

Key messages – projected changes

- *Virtually certain* that increases in the frequency and magnitude of **warm daily temperature extremes** and decreases in **cold extremes** will occur
- *Likely* that the frequency of **heavy precipitation** or the proportion of total rainfall from heavy falls will increase over many areas

Key messages – projected changes

- *Virtually certain* that increases in the frequency and magnitude of **warm daily temperature extremes** and decreases in **cold extremes** will occur
- *Likely* that the frequency of **heavy precipitation** or the proportion of total rainfall from heavy falls will increase over many areas
- *Medium confidence* that **droughts** will intensify in some seasons and areas

Key messages – projected changes

- *Virtually certain* that increases in the frequency and magnitude of **warm daily temperature extremes** and decreases in **cold extremes** will occur
- *Likely* that the frequency of **heavy precipitation** or the proportion of total rainfall from heavy falls will increase over many areas
- *Medium confidence* that **droughts** will intensify in some seasons and areas
- *Very likely* that mean sea level rise will contribute to upward trends in extreme **coastal high water levels**

ipcc
INTERGOVERNMENTAL PANEL ON climate change

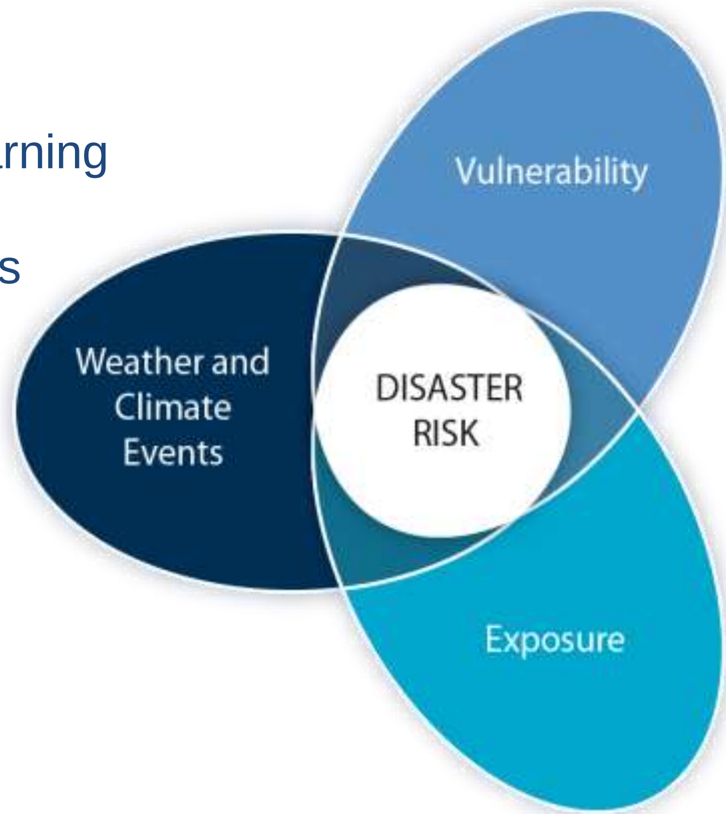
Key messages – projected changes

- *Virtually certain* that increases in the frequency and magnitude of **warm daily temperature extremes** and decreases in **cold extremes** will occur
- *Likely* that the frequency of **heavy precipitation** or the proportion of total rainfall from heavy falls will increase over many areas
- *Medium confidence* that **droughts** will intensify in some seasons and areas
- *Very likely* that mean sea level rise will contribute to upward trends in extreme **coastal high water levels**
- Average **tropical cyclone** maximum wind speed is *likely* to increase, although increases may not occur in all ocean basins. It is *likely* that the global frequency of tropical cyclones will either decrease or remain essentially unchanged

Information on vulnerability, exposure, and changing climate extremes can together inform adaptation and disaster risk management

- poverty reduction
- better education and awareness
- sustainable development

- improved forecasting for warning systems
- reduction of greenhouse gas emissions



- asset relocation
- weather-proofing assets
- early warning systems

Short-term actions don't always provide long term risk reduction

Permafrost thaw

- permafrost requires sub zero temperatures
- melt affects roads, building foundations, airport infrastructure
- infrastructure maintenance needed
- short-term risk reduction won't eliminate long-term melt risk

Effective risk management and adaptation are tailored to local and regional needs and circumstances

- changes in climate extremes vary across regions
- each region has unique vulnerabilities and exposure to hazards
- effective risk management and adaptation address the factors contributing to exposure and vulnerability

Managing the risks: heat waves in Europe

Risk Factors

- lack of access to cooling
- age
- pre-existing health problems
- poverty and isolation
- infrastructure

Risk Management/ Adaptation

- cooling in public facilities
- warning systems
- social care networks
- urban green space
- changes in urban infrastructure

Projected: *likely* increase in heat wave frequency and *very likely* increase in warm days and nights across Europe

Managing the risks: hurricanes in the USA and Caribbean

Risk Factors

- population growth
- increasing property value
- higher storm surge with sea level rise

Risk Management/ Adaptation

- better forecasting
- warning systems
- stricter building codes
- regional risk pooling

Projected globally: *likely* increase in average maximum wind speed and associated heavy rainfall (although not in all regions)

Managing the risks: flash floods in Nairobi, Kenya

Risk Factors

- rapid growth of informal settlements
- weak building construction
- settlements built near rivers and blocked drainage areas

Risk Management/ Adaptation

- reduce poverty
- strengthen buildings
- improve drainage and sewage
- early warning systems

Projected: *likely* increase in heavy precipitation in East Africa

Managing the risks: sea level rise in tropical Small Island Developing States

Risk Factors

- shore erosion
- saltwater intrusion
- coastal populations
- tourism economies

Risk Management/ Adaptation

- early warning systems
- maintenance of drainage
- regional risk pooling
- relocation

Projected globally: *very likely* contribution of sea level rise to extreme coastal high water levels (such as storm surges)

Managing the risks: drought in the context of food security in West Africa

Risk Factors

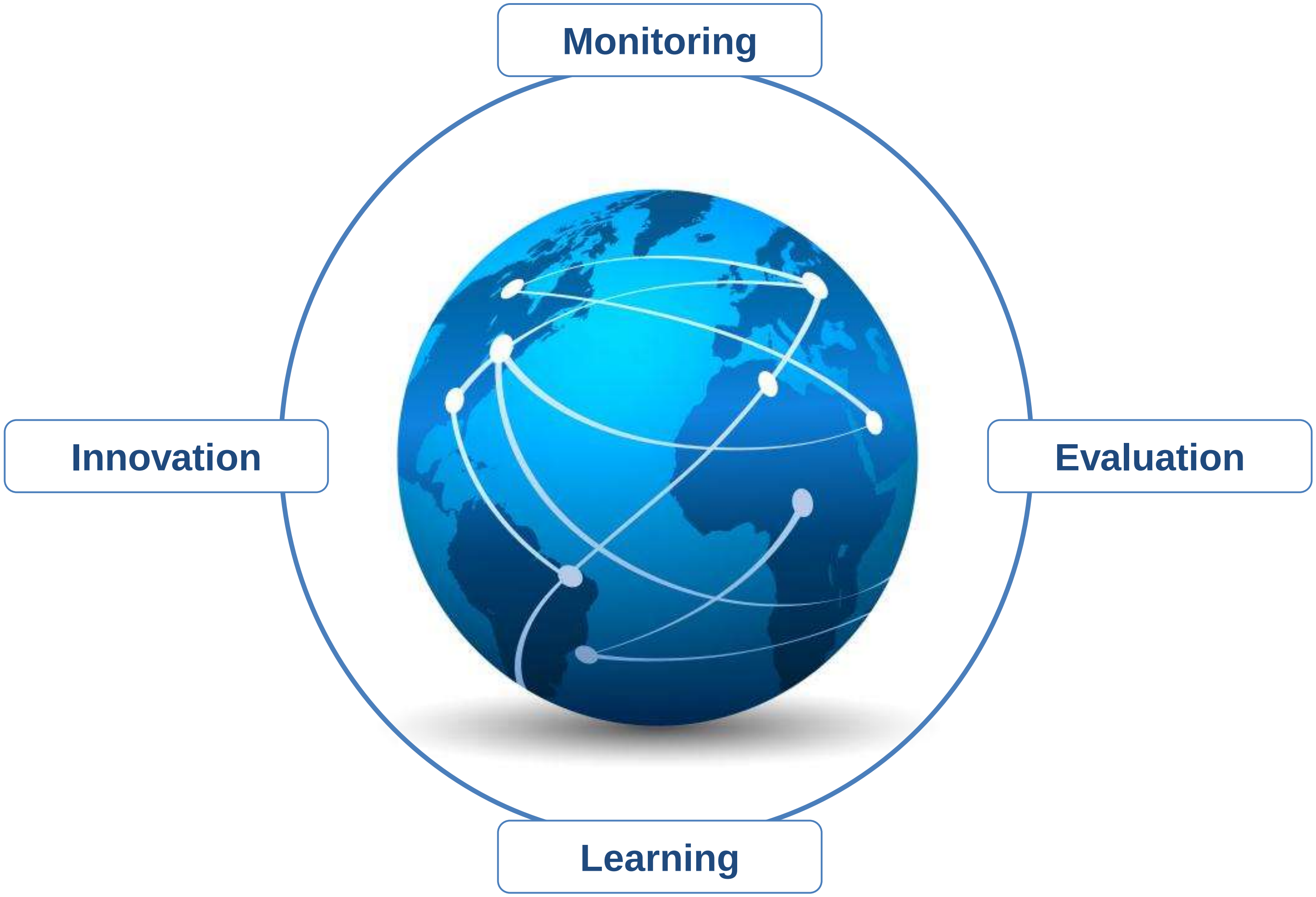
- more variable rain
- population growth
- ecosystem degradation
- poor health and education systems

Risk Management/ Adaptation

- improved water management
- sustainable farming practice
- drought-resistant crops
- drought forecasting

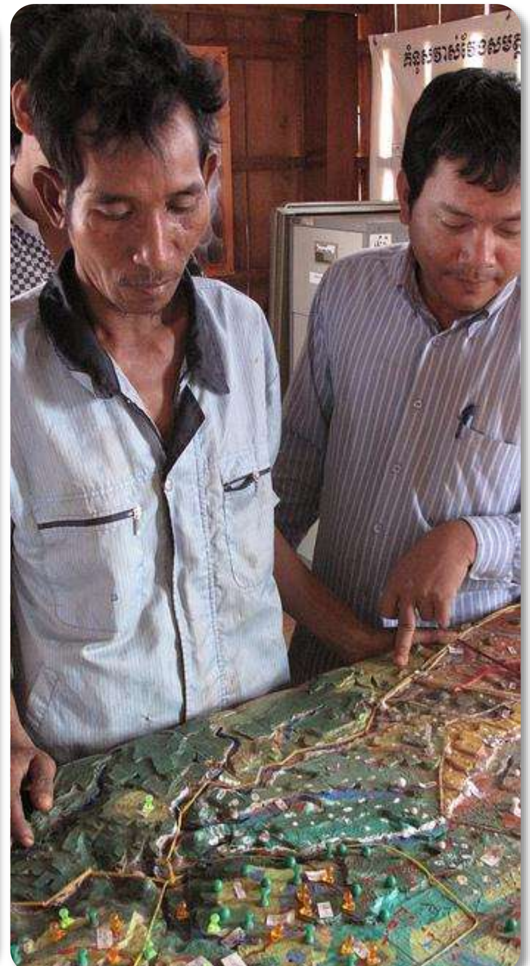
Projected: *low confidence* in drought projections for West Africa

Managing risks of disasters in a changing climate benefits from an iterative process



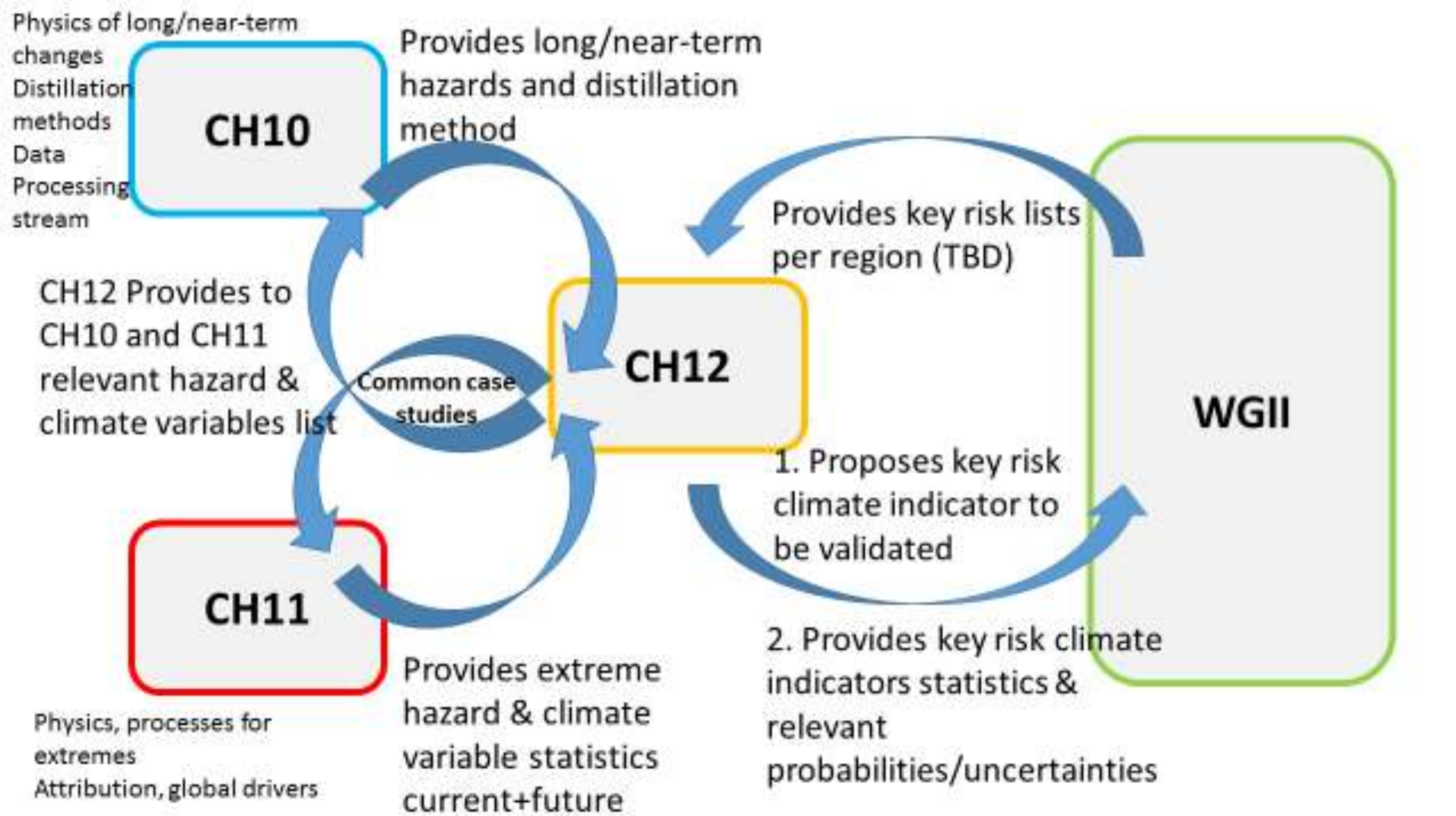
Learning-by-doing and low-regrets actions can help reduce risks now and also promote future adaptation

There are strategies that can help manage disaster risk now and also help improve people’s livelihoods and well-being



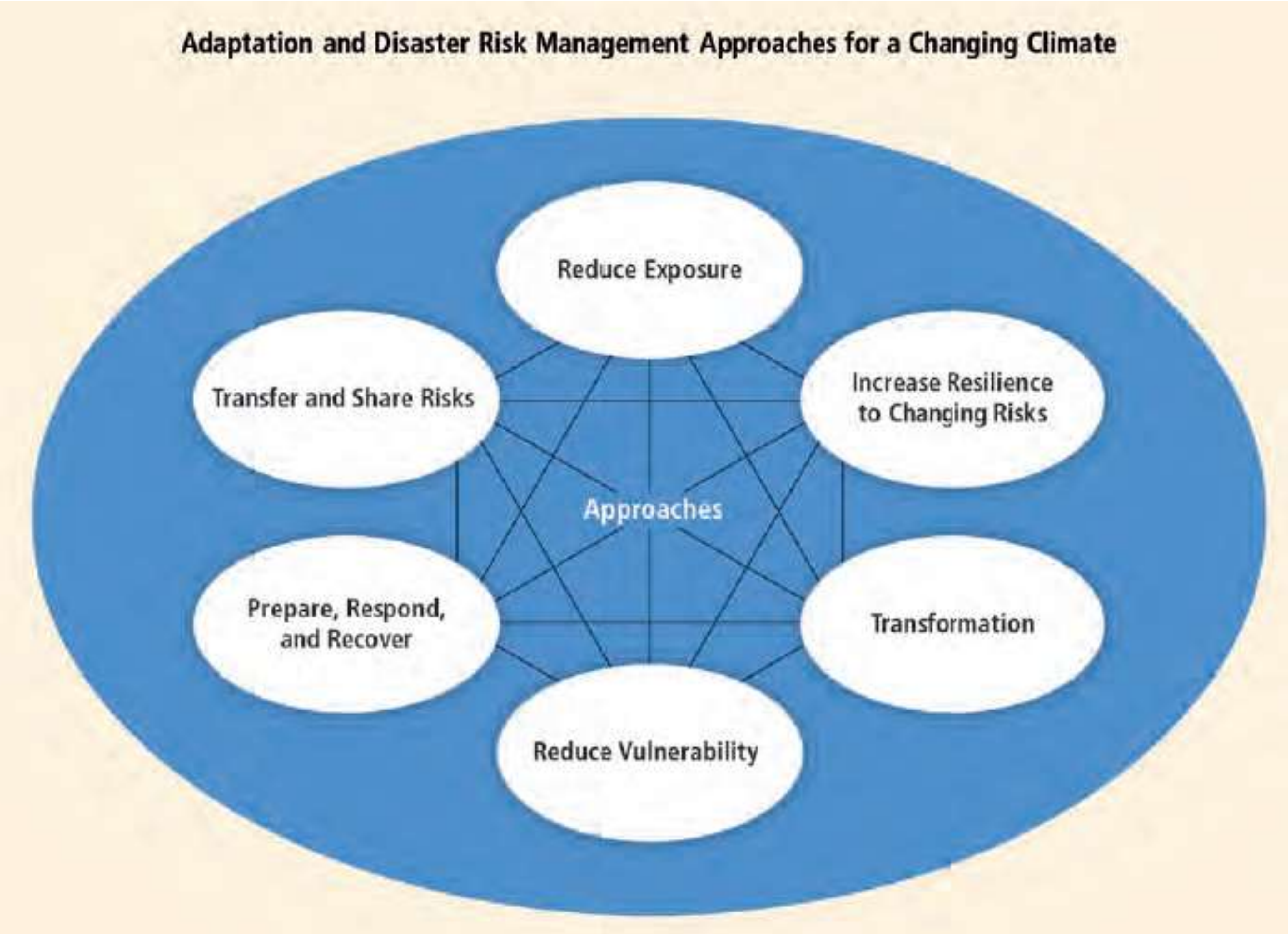
The most effective strategies offer development benefits in the relatively near term and reduce vulnerability over the longer term

AR6-WG1 Chapter 12: Climate change information for regional impact and for risk assessment



Final remarks

- Extreme events are predictable
- Early warning systems by NMHS
- Preparedness
- Resilience
- Adaptation
- National Action Plan for Adaptation(regional, national/provincial/local level)


Adaptation and Disaster Risk Management Approaches for a Changing Climate
Reduce Exposure
Transfer and Share Risks
Increase Resilience to Changing Risks
Approaches
Prepare, Respond, and Recover
Transformation
Reduce Vulnerability

Thank you